AMENDMENTS TO THE CLAIMS

Claims 1-20 (canceled).

21. (previously presented) A method for performing Boolean operations in a digital computer among a first region and a second region, where the regions and the result of the operation are represented as vector tuples, the method comprising:

establishing indexing cells about the regions;

 classifying each indexing cell by the type of interaction between the regions, where the type of interaction includes (boundary, boundary), a (boundary, boundary) indexing cell containing a portion of the boundary of each region;

for each (boundary, boundary) indexing cell:

 defining a pseudo-point at each entrance of each region boundary to the cell and each exit from the cell of each region boundary;

 categorizing the (boundary, boundary) indexing cell based on a relationship of its pseudo-points;

 identifying at least one starting point along the boundary of one of the regions based on:

  the categorization,

  a Boolean operation to be performed, and

  the interior convention of the vector tuples representation;

 accumulating result tuples, including tuples including pseudo points and intersections between region boundaries, encountered in tracing a cycle: from a first at least one starting point, along the first starting point region boundary; in the direction of the first starting point region boundary; and returning to the first starting point, wherein:

  upon encountering each intersection the cycle proceeds along the other region boundary, in the direction of the other region boundary,

  upon encountering a cell edge the cycle proceeds along the cell edge in the direction consistent with the interior convention of the vector tuple representation, and

 until the cycle is completed at the first starting point;

 upon completing a cycle where at least one of a starting point remains untraversed or an intersection between region boundaries remains untraversed, accumulating result tuples, including tuples including pseudo points and

intersections between region boundaries, encountered in tracing a cycle: from a subsequent starting point at the first untraversed starting point or untraversed intersection between region boundaries along the subsequent starting point region boundary, in the direction of the subsequent starting point region boundary, and returning to the subsequent starting point, wherein:

upon encountering each intersection the cycle proceeds along the other region boundary, in the direction of the other region boundary,

upon encountering a cell edge the cycle proceeds along the cell edge in the direction consistent with the interior convention of the vector tuple representation, and

until the cycle is completed at the subsequent starting point; and

discarding duplicate tuples and tuples comprising only cell edges, until all starting points and intersections of the region boundaries have been traversed.

22. (previously presented) The method of Claim 21 wherein establishing indexing cells about the regions comprises:

establishing indexing cells such that each (boundary, boundary) indexing cell contains no more than one entry and one exit of the boundary of each region.

23. (previously presented) The method of Claim 22 where categorizing each (boundary, boundary) indexing cell based on a relationship of its pseudo-points further comprises:

categorizing each (boundary, boundary) indexing cell as one of the following based on the order of pseudo points encountered in a counterclockwise traverse of the (boundary, boundary) indexing cell boundary:

first region entry (1e), first region exit (1x), second region entry (2e), second region exit (2x) – (i.e., Category 1);

1e, 2x, 2e, 1x – (Category 2);

1e, 2e, 2x, 1x – (Category 3);

1e, 1x, 2x, 2e – (Category 4);

1e, 2x, 1x, 2e – (Category 5); and

1e, 2e, 1x, 2x – (Category 6).

24. (previously presented) The method of Claim 23 wherein identifying at least one starting point along the boundary of at least one region based on categorization, the Boolean operation,

and the interior convention used in the quadtree-indexed vector tuples representation further comprises:

> where the convention is "inside to the right" and at least one intersection between boundaries exists in the (boundary, boundary) indexing cell:

>> where the Boolean operation is intersection:

>>> for Category 1 identifying the starting point as the first intersection between region boundaries,

>>> for Category 2 identifying the starting point as 2e and 1e,

>>> for Category 3 identifying the starting point as 2e,

>>> for Category 4 identifying the starting point as 1e,

>>> for Category 5 identifying the starting point as 1e,

>>> for Category 6 identifying the starting point as 2e;

>> where the Boolean operation is union:

>>> for Category 1 identifying the starting point as 2e and 1e,

>>> for Category 2 identifying the starting point as the first intersection between region boundaries,

>>> for Category 3 identifying the starting point as 1e,

>>> for Category 4 identifying the starting point as 1e,

>>> for Category 5 identifying the starting point as 2e,

>>> for Category 6 identifying the starting point as 2e;

> where the convention is "inside to the left" and at least one intersection point between boundaries exists in the (boundary, boundary) indexing cell: :

>> where the Boolean operation is intersection:

>>> for Category 1 identifying the starting point as 2e and 1e

>>> for Category 2 identifying the starting point as the first intersection between region boundaries,

>>> for Category 3 identifying the starting point as 1e,

>>> for Category 4 identifying the starting point as 1e,

>>> for Category 5 identifying the starting point as 2e, and

>>> for Category 6 identifying the starting point as 2e; and

>> where the Boolean operation is union:

>>> for Category 1 identifying the starting point as the first intersection between region boundaries,

>>> for Category 2 identifying the starting point as 2e and 1e,

for Category 3 identifying the starting point as 2e,

for Category 4 identifying the starting point as 2e,

for Category 5 identifying the starting point as 1e, and

for Category 6 identifying the starting point as 1e.

25. (previously presented)   The method of Claim 21 wherein, accumulating tuples further comprises:

excluding tuples representing indexing cell boundary segments but including tuples
representing pseudo points and intersections between the region boundaries.

26. (previously presented)   A computer program product for performing Boolean operations among a first region and a second region, where the regions and the result of the operation are represented as region quadtree-indexed vector tuples, the computer program product comprising:

a computer readable medium;

an indexing module stored on the medium and operable for:

establishing indexing cells about the regions

a classifying module stored on the medium and operable for:

classifying each indexing cell by the type of interaction between the
regions, where the type of interaction includes (boundary,
boundary), a (boundary, boundary) indexing cell containing a
portion of the boundary of each region;

a definition module stored on the medium and operable for:

defining a pseudo-point at each entrance of each region boundary to the cell and
each exit from the cell of each region boundary in each (boundary,
boundary) indexing cell;

a categorization module stored on the medium and operable for:

categorizing the (boundary, boundary) indexing cell based on a relationship of its
pseudo-points;

an identification module stored on the medium and operable for:

identifying at least one starting point along the boundary of one of the regions for
each (boundary, boundary) indexing cell based on:

the categorization,

the Boolean operation, and

the interior convention of the vector tuples representation;

an accumulation module stored on the medium and operable, for each (boundary, boundary) indexing cell, for:

accumulating result tuples, including tuples including pseudo points and intersections between region boundaries, encountered in tracing a cycle: from a first at least one starting point, along the first starting point region boundary; in the direction of the first starting point region boundary; and returning to the first starting point, wherein:

upon encountering each intersection the cycle proceeds along the other region boundary, in the direction of the other region boundary; and

upon encountering a cell edge the cycle proceeds along the cell edge in the direction consistent with the interior convention of the vector tuple representation;

until the cycle is completed at the first starting point;

upon completing a cycle where at least one of a starting point remains untraversed or an intersection between region boundaries remains untraversed, accumulating result tuples, including tuples including pseudo points and intersections between region boundaries, encountered in tracing a cycle: from a subsequent starting point at the first untraversed starting point or untraversed intersection between region boundaries along the subsequent starting point region boundary, in the direction of the subsequent starting point region boundary, and returning to the subsequent starting point, wherein:

upon encountering each intersection the cycle proceeds along the other region boundary, in the direction of the other region boundary, and

upon encountering a cell edge the cycle proceeds along the cell edge in the direction consistent with the interior convention of the vector tuple representation;

until the cycle is completed at the subsequent starting point, and

discarding duplicate tuples and tuples comprising only cell edges, until all starting points and intersections of the region boundaries have been traversed.

27. (previously presented) The computer program product of Claim 26 wherein establishing indexing cells about the regions comprises:

> establishing indexing cells such that each (boundary, boundary) indexing cell contains no more than one entry and one exit of the boundary of each region.

28. (previously presented) The computer program product of Claim 27 where categorizing each two-region boundary indexing cell based on a relationship of its pseudo-points further comprises:

> categorizing each (boundary, boundary) indexing cell as one of the following based on the order of pseudo points encountered in a counterclockwise traverse of the (boundary, boundary) indexing cell boundary:

>> first region entry (1e), first region exit (1x), second region entry (2e), second region exit (2x) – (i.e., Category 1);

>> 1e, 2x, 2e, 1x – (Category 2);

>> 1e, 2e, 2x, 1x – (Category 3);

>> 1e, 1x, 2x, 2e – (Category 4);

>> 1e, 2x, 1x, 2e – (Category 5); and

>> 1e, 2e, 1x, 2x – (Category 6).

29. (previously presented) The computer program product of Claim 28 wherein identifying a starting point along the boundary of at least one region based on categorization, the Boolean operation, and the interior convention used in the quadtree-indexed vector tuples representation further comprises:

> where the convention is "inside to the right" and at least one intersection between boundaries exists in the (boundary, boundary) indexing cell:

> where the Boolean operation is intersection:

>> for Category 1 identifying the starting point as the first intersection between region boundaries,

>> for Category 2 identifying the starting point as 2e and 1e,

>> for Category 3 identifying the starting point as 2e,

>> for Category 4 identifying the starting point as 1e,

>> for Category 5 identifying the starting point as 1e,

>> for Category 6 identifying the starting point as 2e;

> where the Boolean operation is union:

>> for Category 1 identifying the starting point as 2e and 1e,

for Category 2 identifying the starting point as the first intersection between region boundaries,

for Category 3 identifying the starting point as 1e,

for Category 4 identifying the starting point as 1e,

for Category 5 identifying the starting point as 2e,

for Category 6 identifying the starting point as 2e;

where the convention is "inside to the left" and at least one intersection point between boundaries exists in the (boundary, boundary) indexing cell: :

where the Boolean operation is intersection:

for Category 1 identifying the starting point as 2e and 1e

for Category 2 identifying the starting point as the first intersection between region boundaries,

for Category 3 identifying the starting point as 1e,

for Category 4 identifying the starting point as 1e,

for Category 5 identifying the starting point as 2e, and

for Category 6 identifying the starting point as 2e; and

where the Boolean operation is union:

for Category 1 identifying the starting point as the first intersection between region boundaries,

for Category 2 identifying the starting point as 2e and 1e,

for Category 3 identifying the starting point as 2e,

for Category 4 identifying the starting point as 2e,

for Category 5 identifying the starting point as 1e, and

for Category 6 identifying the starting point as 1e.

30. (previously presented) The computer program product of Claim 27 wherein, accumulating tuples further comprises:

excluding tuples representing indexing cell boundary segments but including tuples representing pseudo points and intersections between the region boundaries.